Host Preference of Blood Feeding Mosquitoes in Rural Areas of Southern Tamil Nadu, India

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Abstract: Mosquitoes use plant sugars and vertebrate blood as nutritional resources. When searching for blood hosts, some mosquitoes express preferential behavior for selected species. To control the outbreak of mosquito borne diseases it is necessary to observe their multiple host preference behavior which enables us to know their main host. The study was conducted in selected rural areas of Virudhunagar and Tirunelveli districts, Southern Tamil Nadu, India. The study period was one year from January 2014 to December 2014. The mosquitoes have been collected by man landing method to know their blood feeding behavior. The agar gel diffusion technique was used to identify the feeding pattern or host preference behavior exhibited by mosquitoes. Totally ten species have been collected in which Aedes aegypti, Aedes albopictus, Aedes vittatus, Anopheles barbirostris, Armigeres subalbatus and Culex tritaeniorhynchus were preferred to feed on human indicating anthropophilic pattern and Anopheles subpictus, Culex gelidus, Culex quinquefasciatus and Mansonia uniformis showed predominantly zoophilic pattern that feed more on animals than humans.

Key words: Host Preference, Anthropophilic and Zoophilic Pattern

INTRODUCTION

Mosquitoes belong to the most important group of disease vectors, as exemplified by the large number of species involved in the transmission of human and animal parasites and pathogens. Several of the world’s most prevalent infectious diseases, notably malaria, lymphatic filariasis and dengue, as well as less common diseases such as Japanese encephalitis, chikungunya, Rift Valley fever, West Nile virus and Usutu virus, are transmitted by mosquitoes. Transmission between vertebrate hosts is achieved by the blood-feeding habit of the mosquitoes, which enables the disease agents to successfully become established in and be transmitted by their arthropod hosts. Selection of a blood host that is essential for the parasite/pathogen to successfully complete its life cycle is therefore important. The blood-feeding habit of mosquitoes is part of their intrinsic character, as blood proteins are essential nutrients for egg production and reproductive fitness [1].

In addition to plant sugars, blood also serves as a source of metabolic energy, depending on the internal state of the insect [2]. Many blood-feeding mosquitoes express a nonspecific host preference, suggesting that blood source and quality are irrelevant for reproductive fitness. However, studies have shown that blood quality and hence host species, may affect reproductive output [3].

Knowledge of the blood-feeding preferences of a mosquito species provides important insight into the dynamics of virus transmission and allows vector control authorities to design and implement efficient strategies for vector control [4]. The choice of blood meal is influenced by several factors including host availability, nutritional requirements, intrinsic host preferences of the species and vector density [5]. Here, we focused on the feeding behavior of mosquito vectors in some rural areas of Virudhunagar and Tirunelveli district, Tamil Nadu, South India. The objective is to know the current knowledge on mosquitoes host preference.

MATERIALS AND METHODS

Study Area: The study was conducted in selected rural areas of Virudhunagar and Tirunelveli district, Southern Tamil Nadu, India. The study sites were selected on the
The geographic location of Virudhunagar district is 11°56'21.84" North latitude to 79°29'51.23" East longitude with a mean sea level of 53.6 m. The total area of Virudhunagar District is 3445.73 (km²). The geographic location of Tirunelveli district is between 8°05' and 9°30' north latitude and 77°05' and 78°25' east longitude. The district covers an area of 6,823 km². The study was undertaken for a period of one year from January 2014 to December 2014.

Methodology

Mosquito Collection and Preservation: An intensive collection of blood engorged female mosquitoes was done between 07 h and 08 h and 17 h and 18 h to identify the blood of their hosts and confirm their host preference behavior in order to verify their changing pattern of feeding behavior in an area during the specified period of study, following the method adopted by Pandian and Chandrashekaran [6]. To minimize the damage of body parts and to collect the biting mosquitoes, a very thin and transparent (1x1 inch size) plastic vials were used. All preserved wild caught mosquitoes were identified up to species level by using standard taxonomic keys.

Host Seeking Behavior: The blood-fed mosquitoes were collected from human settlement area, cattle sheds and fowl houses etc. After identification of the species, the abdomens of the mosquitoes were squashed on a Whatman No.1 filter paper and a thin smear of blood was prepared. By following the method of Rao [7], the agar gel diffusion technique was used to identify the feeding pattern or host preference behavior exhibited by vectors. Positive results were obtained by observing the formation of precipitin line against the blood serum of host.

RESULT AND DISCUSSION

The abundance of a certain animal species often determines the host choice of a mosquito, especially if this mosquito species is opportunistic [8]. However, the host choice of mosquitoes with a clear host preference may also change when their preferred host becomes less abundant [9]. An intensive collection of blood engorged female mosquitoes was done between 07 h and 08h and 17h and 18h. Ten species of mosquitoes belonging to five genera namely Aedes, Anopheles, Armigeres, Culex and Mansonia were observed in the study areas. In which a total of 398 full fed mosquitoes were collected and assayed to know the blood feeding preference. Positive results were obtained by observing the formation of precipitin line against the blood serum of host. In the study areas bovine feeding was observed in 2 (3.57%) Aedes aegypti, 3 (8.82%) Aedes albopictus, 25 (67.55%), 23 (57.50%) Anopheles barbirostris, 1 (6.66%) Armigeres subalbatus, 36 (78.3%) Culex gelidus, 56 (53.32%) Culex quinquefasciatus, 71 (44.72%) Culex tritaeniorhynchus and 19 (100%) Mansonia uniformis.

Table 1: Preferential host selection behavior of mosquitoes in rural areas of Virudhunagar and Tirunelveli districts, Tamil Nadu, India.

<table>
<thead>
<tr>
<th>S.No</th>
<th>Mosquito species</th>
<th>Buffalo (%)</th>
<th>Cow (%)</th>
<th>Goat (%)</th>
<th>Fowl (%)</th>
<th>Human (%)</th>
<th>Host preference pattern</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Aedes aegypti</td>
<td>0</td>
<td>3.57</td>
<td>0</td>
<td>0</td>
<td>96.42</td>
<td>a&gt;z</td>
</tr>
<tr>
<td>2.</td>
<td>Aedes albopictus</td>
<td>0</td>
<td>8.82</td>
<td>0</td>
<td>5.88</td>
<td>85.29</td>
<td>a&gt;z</td>
</tr>
<tr>
<td>3.</td>
<td>Aedes vittatus</td>
<td>0</td>
<td>00</td>
<td>0</td>
<td>0</td>
<td>100</td>
<td>a</td>
</tr>
<tr>
<td>4.</td>
<td>Anopheles subpictus</td>
<td>18.91</td>
<td>35.13</td>
<td>13.51</td>
<td>0</td>
<td>32.43</td>
<td>a&lt;z</td>
</tr>
<tr>
<td>5.</td>
<td>Anopheles barbirostris</td>
<td>30.00</td>
<td>27.50</td>
<td>0</td>
<td>5.71</td>
<td>40.95</td>
<td>a&lt;z</td>
</tr>
<tr>
<td>6.</td>
<td>Armigeres subalbatus</td>
<td>0</td>
<td>6.66</td>
<td>0</td>
<td>19.56</td>
<td>45.65</td>
<td>a&lt;z</td>
</tr>
<tr>
<td>7.</td>
<td>Culex gelidus</td>
<td>13.09</td>
<td>45.65</td>
<td>19.56</td>
<td>0</td>
<td>21.73</td>
<td>a&lt;z</td>
</tr>
<tr>
<td>8.</td>
<td>Culex quinquefasciatus</td>
<td>17.14</td>
<td>27.61</td>
<td>8.57</td>
<td>5.71</td>
<td>40.95</td>
<td>a&lt;z</td>
</tr>
<tr>
<td>9.</td>
<td>Culex tritaeniorhynchus</td>
<td>13.15</td>
<td>31.57</td>
<td>0</td>
<td>0</td>
<td>55.26</td>
<td>a&lt;z</td>
</tr>
<tr>
<td>10.</td>
<td>Mansonia uniformis</td>
<td>31.57</td>
<td>68.42</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>z</td>
</tr>
</tbody>
</table>

a = anthropophilic pattern
z = zoophilic pattern
Generally, the host seeking activity of mosquitoes is not uniform; instead most species show a pronounced biting rhythm characteristic for each species [10]. The analyses of blood meals of wild caught mosquitoes indicated that *Aedes aegypti*, *Aedes albopictus*, *Anopheles barbirostris*, *Armigeres subalbatus* and *Culex tritaeniorhynchus* showed were showed positive results for human indicated their endophilic nature of feeding pattern by which these mosquitoes preferred to feed on human in their less active time. These findings were similar to the findings of Scott *et al.* [11] and it was reported that *Ae. aegypti* showed multiple blood feeding behavior on human at higher feeding rates. *Ae. albopictus* was known to be an opportunistic feeder upon most groups of vertebrates, including birds, reptiles and amphibians, although preferring mammals [12]. *Anopheles subpictus*, *Culex gelidus*, *Culex quinquefasciatus* and *Culex tritaeniorhynchus* showed predominantly zoophilic pattern. Niebylski *et al.* [13] that the *Culex quinquefasciatus* was the opportunistic feeders that feed readily on humans or birds. Findings of Arunachalam *et al.* [14] also *Culex tritaeniorhynchus* had predominantly fed on cattle (56.6%) and to a lesser extent on ducks, fowl, goats and humans (< 2%). Among the species *Aedes vittatus* exclusively preferred to feed on human indicating anthropophilic pattern and *Mansonia uniformis* exhibited a typical zoophilic pattern.

**CONCLUSION**

These feeding patterns were consistent because the patterns were more or less similar in all the collections during the study period in the selected sites of the study area.

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**REFERENCES**


